AU/AWC/115/1999-04

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BAD NEWS BORSCHT:

US SPACE GETS TAKEN FOR A RIDE

by

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A Research Report Submitted to the Faculty

In Partial Fulfillment of the Graduation Requirements

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April 1999

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Preface

As I began to look for a research topic that revolved around current space issues, I was struck by a number of trends in the space arena that seemed to be converging to everyone's satisfaction. These trends, of course, have to do with the reduction in resources available to military and civil space organizations for their continued primacy in the space industry and the concurrent meteoric rise of commercial space interests and capabilities. On the surface this appears to be an ideal situation—military and civil programs will partner with and piggy-back on commercial industry to more efficiently use their precious dwindling resources. This situation looks especially convenient in the thorny launch arena. The idea of simply "contracting out" the difficult launch part of the equation until systems such as the expendable launch vehicle come on line is almost too good to be true. In fact, I believe it is too good to be true and that is what led to the creation of this paper. The difficulty in addressing this issue is that it is evolving almost on a daily basis and new events and information present themselves in every direction—at least the topic has not been boring.

I would like to acknowledge the guidance and assistance of my research advisor Col Victor P. Budura of the Air War College staff. His extensive background of space related issues was invaluable to the completion of this project.

Abstract

This paper looks at the evolving relationships between military, civil and commercial space interests in an international context. More specifically, it examines the question of whether the United States' increased dependency on the commercial space sector for critical functions has ultimately made us overly dependent on the Russian space industry. This dependence would include critical functions for our commercial, civil and defense needs.

In order to examine the above question, this paper focuses on several related issues evolving in the space arena today. The first issue is the recent change in US space policy emphasizing partnerships with industry. The second issue is the new surge in commercial space interests and capabilities worldwide. The third issue is a look at the Russian space industry, its history, strengths and challenges. Finally, the paper will an assessment of the potential problems generated by the above issues and the conclusions that can be drawn.

The research and findings show a determined and deliberate effort by civil and military space entities to partner with and increasingly rely upon the commercial space sector. At the same time commercial space consortiums are becoming increasingly multinational and interdependent globally to take advantage of the infrastructure, expertise and equipment of various nations. For critical space functions such as launch capability, there are only a few countries that have this ability. One of the preeminent

spacefaring nations is of course the Russians. They are increasingly becoming a vital component to almost every space project. Their abundance of launch systems, infrastructure and experience have made them almost indispensable to the commercial space industry worldwide. On the face of it, this partnering with the Russians appears to be an almost ideal situation, as each benefit from the situation. This would true if it were not for the almost insurmountable political, economic and institutional problems that are effecting Russia today.

The conclusion of this paper is that making Russia an integral part of our commercial, civil and military space equation will ultimately create a vulnerability that will hurt us in all three sectors. We have already seen the beginning of this trend with Russia's failure to live up to its commitments regarding the International Space station and the precipitous decline of their space capabilities.

Chapter 1

Introduction

Space, No Longer a Government Cottage Industry

> *Space is too expensive, too interdependent, too complex, and too important to go it alone.*
>
> —General Richard B. Myers, Commander U.S. Space Command[1]

As the trend towards commercialization of space increases at breakneck speed, the partnership between military space needs and the civil/commercial sector is viewed more and more as an ideal relationship. Last year for the first time "annual spending for commercial space programs finally exceeded the U.S government's $26 billion annual space budget."[2] Air Force General Howell Estes, who recently retired as commander of U.S. Space Command, was an outspoken proponent of fostering a closer relationship with the American space industry. He received high marks from industry for dispelling much of the distrust that had existed, primarily over the scheduling of commercial launches.[3] In fact, Estes' vision as the military's top space official (as expressed in his Long Range Plan (LRP) for US Space Command) emphasized "global partnerships" that would allow the "leveraging" of civil and commercial space systems to "provide increased opportunity to share both costs and risks."[4]

Leveraging the commercial success of industry is not merely restricted to the U.S.; governments and militaries around the world are realizing the benefits of these type of relationships.[5] The idea of global partnerships has already become an essential ingredient for both the civil and commercial space sectors. Because of the limited number of countries with extensive space infrastructure and experience, companies are almost forced to cooperate in international joint ventures in order to be successful. International programs bring a number of advantages to the table: they help eliminate the duplication of highly capital intensive facilities and distribute operating expenses across a number of partners resulting in significant cost savings for individual participants; they combine scientific and technical knowledge and draw upon each country's specialties; they can play an important part in diplomacy and may lead to greater cultural and economic ties; and finally, they are a way of providing economic assistance.[6] A good example of a global partnership is the international consortium called Iridium, which put a constellation of 66 satellites into space to link more than 100 countries via mobile-telephone service.[7]

One important area that will require a lot of cooperation in the near future is in the space launch business. The current market for launch services consists of a small oligopoly, of which the United States and Russia are two of the main actors.[8] With its vast amount of space experience and bargain basement launch prices, the Russian space industry has become an almost indispensable global partner for many businesses. In fact, the "United States government is actively pursuing cooperation with Russia on a wide range of space activities, including the International Space Station. In addition, U.S. aerospace firms have entered into joint ventures, licensing agreements, and cooperative

technical agreements with a variety of newly organized Russian counterparts."[9] "The recent broad rapprochement between the United States and the nations of the Former Soviet Union (FSU) has transformed the environment for cooperation in space with Russia and other FSU states that would have been unimaginable just a few years ago."[10] What we are seeing then, is that as the interdependence between military and civil/civilian space programs increases, so does the ultimate interdependency of the US military space program and the international space industries of other nations by virtue of these global partnerships.

The thesis of this paper is that the United States' transition to increased dependency on the commercial sector for critical space functions has ultimately made us overly dependent on the Russian space industry for some of our most critical commercial, civil and defense needs.

In order to analyze this thesis, this paper will look at the following areas: first, the recent change in US space policy focusing on partnerships with industry; second, the new surge in the commercial space industry world-wide; third, the Russian space industry and its history, strengths and challenges; and finally the potential problems that will face the US space program in the near future and what conclusions we can ultimately draw.

Notes

[1] Peter Grier, "Partners in Space," *Air Force Magazine* 82, no. 2 (February 1999): 28-32.

[2] Ben Iannotta, "Commercial Trend Sparks Security Worries," *Space News*, 14-20 September 1998, 14.

[3] "Estes is 'Heartened' by his Successor's Space Views," *Space Business News*, 5 August 1998, 1.

[4] US Space Command, *Long Range Plan: Executive Summary*, Director of Plans, (Peterson AFB, Co: US Space Command), 12.

[5] Lt Gen Lord, "Three Considerations for America's Future in Space," Speech given to the FAA's Symposium on Commercial Space Transportation in the 21st Century at the

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Key Bridge Marriot Hotel, Arlington, VA, 10 February 1998, n.p.; on-line, Internet, 13 January 1999, available from http://www.spacecom.af.mil/hqafspc/library/speeches/sp_considerations.htm

[6] W.D. Kay, *Can Democracies Fly in Space*? (Westport, Connecticut: Praeger Publishers, 1995), 130-131.

[7] "Iridium will be Ready to Provide Service by New Start Date of Nov. 1," *Space Business News*, 16 September 1998, 3.

[8] John J. Egan, "Perspective on Space Commerce – is it Real*?" Space Energy and Transportation* 2, no. 2 (1997): 15.

[9] US Congress, Office of Technology Assessment, "US-Russian Cooperation in Space," 103d Cong., April 1995 (Washington, DC: U.S. Government Printing Office), 1.

[10] U.S. Russian Cooperation, iii.

Chapter 2

Industry Partners

" … it is unlikely anyone is going to give the Air Force a bigger slice of the pie to cover our expansion into space."

—General Howell M. Estes III,
former commander of Air Force Space Command

" What a great day this is … for the Air Force and our industry partners."

—General Richard B. Meyers, Commander of Air Force Space Command, upon signing the first Commercial Space Operations Support Agreements, October 27, 1998.

Traditional space activists in government are looking to the private sector as a source of funding to replace that which they have lost from the treasury—they want to maintain their programs by spending other peoples' money if possible.

—John J. Egan, President, Egan International[1]

With post Cold War defense purse strings becoming increasingly tighter and the Air Force realizing more and more that its future will be bound up in space, the need to pursue every avenue of economy is crucial. With commercial payload launches now outnumbering government launches, the trend for future economy appears to be more reliance on the commercial sector.[2] Trans-Atlantic consolidation and "Globalization" are becoming a fact of life for major aerospace industries who want to share costs, risks, and technology, and they are waiting for the DOD to get its regulatory act together so they can get on with business.[3] Michael Mott, associate deputy administrator for NASA states

flatly that "budget restrictions are forcing the government to rely increasingly on commercial technology in space."[4]

Space Command and CinCSpace, as the single focal point for military space, has made it their principle objective to identify partnering candidates in order to develop an integrated systems approach.[5] These global partnerships in space "allow the military and its partners to do more with the limited resources available to each than could be possibly accomplished alone."[6] Air Force Space Command is actively pursuing mutually beneficial partnerships with the National Reconnaissance Office (NRO), the Federal Aviation Administration, the National Oceanic and Atmospheric Administration, NASA and commercial industry.[7] In April 1997, Gen Estes and Mr. Goldin, Administrator of NASA, signed a formal agreement establishing a Partnership Council to save time/money and improve performance.[8] In October of 1998 the command also signed a partnership agreement with the largest partners in the commercial launch industry.[9]

These partnerships, especially with industry, have become critical because of three trends simultaneously impacting the U.S. military, civil, and commercial space sectors. The first trend is the continued decline of defense dollars as a percentage of the Gross National Product and the need to cooperate with civil space partners for more efficient use of resources.[10] The second is the dramatic shift of space pioneering leadership from government to industry after five decades of driving space developments.[11] The third trend is the rapid advance of technology, forcing government to be more adept at leveraging key enabling technologies.[12]

The need for partnership is especially acute in the area of launch operations. "Both NASA and the Defense Department are pursuing launch programs in the hopes of

reducing launch costs by a least 25 percent."[13] The launch issue is especially thorny; "it doesn't matter how good our satellites are if we can't get them up into space."[14] Mr. Gil Klinger, acting deputy undersecretary of Defense for Space echoes these sentiments, stating that "commercial developments will drive costs down and ultimately be very positive for the government," and the "dramatic sea change is the extent to which the availability of commercial products and commercial systems and services are affecting how we think about where we want to go in terms of things like launch…"[15]

General Estes stated that the lowering of launch costs was the key to affordable use of space.[16] In the command's Long Range Plan (LRP), he designated this issue as the command's #1 priority.[17] General Estes' vision for Spacecom was that through increased cooperation with civil and commercial interests, technological improvements and competition would reduce low earth orbit costs from thousands of dollars per pound to hundreds of dollars per pound by 2015.[18] Spacecom's LRP puts much emphasis on more and more opportunities to cooperate with commercial ventures to achieve economies in the launch business "as a matter of priority."[19] In looking at the projections for "Assured Access" in the LRP (see diagram a), it is currently red (< 30% mission capable) and assesses to be yellow (< 70% mission capable) until the year 2012 with the projected development of launch on demand systems.[20]

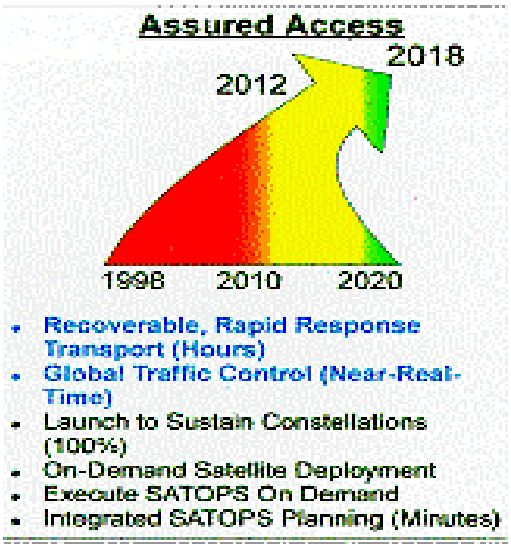

Figure 1. Space com Assured Access Forecast

The primary criterion in assured access is "to reduce the cost of low earth orbit to less than $1,000 per pound."[21] What this gap means is that until expendable and reusable launch systems are developed, there will be a projected period of more than ten years where the US will rely increasingly on civil and commercial partners utilizing variants of current launch systems for most of its launch needs. The military space leadership has not only encouraged this trend towards increased reliance on civil and commercial industries; it has almost become inevitable.

Recognition of the need for cheaper launch alternatives has not been lost on other international competitors as well. Countries such as China are striving to expand their launch services to meet domestic and international needs. Despite lacking the experience and technology of the United States and Russia, China is trying to establish themselves in the international launch market and bills its rockets as "cheap alternatives to U.S., European and Japanese launch vehicles."[22] Chinese credibility, however, has not been sterling with a series of disasters with their Long March rocket to include the recent failure of the rocket in launching an U.S. commercial satellite.[23]

Notes

[1] Egan, 13.

[2] Katherine McIntire Peters, "Space Wars," *Government Executive Magazine*, April 1998, 12 pp.

[3] Distinguished Senior Leadership series lecture, Air War College, Montgomery, Al., (9 December 1998)

[4] Peters, 5.

[5] Douglas J. Gillert, "Estes Advocates Space Partnerships," *American Forces Press Service*, n.p.; on-line, Internet, 4 February 1999, available from http://www. spacecom. af.mil//usspace/partner.htm

[6] General Howell M. Estes III, "Global Partnerships Expand Space Capabilities," USSPACECOM News Release No. 14-98, 9 April 1998, n.p.: on-line, Internet, 4 February 1999, available from http://www.spacecom.af.mil/usspace/new14-98.htm

[7] Lt General Lord, "Three Considerations for America's Future in Space," A speech given by Gen Lord at the FAA's Commercial Space Transportation Symposium on 10 Feb 1998 in Arlington Virginia, n.p.; on-line, Internet, 13 January 1999, available from http://www.spacecom.af.mil/hqafspc/library/speeches/sp_considerations.htm

[8] Ibid.

[9] Gen Richard B. Meyers, "Integrating Space in an Uncertain Era," A speech given by Gen Myers, on 13 Nov 1998 to the Air Force association in Los Angeles California, n.p.; on-line, Internet, 13 January 1999, availale from http://www.spacecom.af.mil/ hqafspc/libray/speeches/Default.htm

[10] Lord, 5.

[11] Ibid.

[12] Ibid.

[13] Peters, 5.

[14] Ibid.

[15] Ibid.

[16] *Long Range Plan*, 18.

[17] Ibid.

[18] Ibid.

[19] Ibid.

[20] *Long Range Plan*, 7.

[21] Ibid.

[22] "China aims to put Man in Space Soon," *Reuters*, 20 March 1998, n.p.; on-line, Internet, 19 January 1999, available from http://www.nacomm.org/news/ 1998/qtr1/ chinaaim.htm

[23] "Space Systems/Loral China Issues – Fact Sheet," Loral Space and Communications Web Page, 18 May 1998, n.p.; on-line, Internet, 19 January 1999, available from http://www.loral.com/china-investigation.html

Chapter 3

The Rise of Commercial Space

> *On 24 December 1997, at the Svobodnyy Cosmodrome situated in a far corner of Siberia, a modified Russian SS-25 intercontinental ballistic missile arched skyward, but rather than the single thermonuclear weapon it was originally designed to deliver, it carried a peculiar cargo—a US-made imaging satellite.*
>
> —Lt Col Larry K. Grundhauser, USAF[1]

The civil and commercial trends that have made this cooperation with the military almost inevitable have been the astonishing growth of the commercial space market. The commercial satellite industry is witnessing annual growth rates of twenty percent.[2] Today there are 1,100 companies in 53 different countries developing, manufacturing and operating space systems (Table 1).[3]

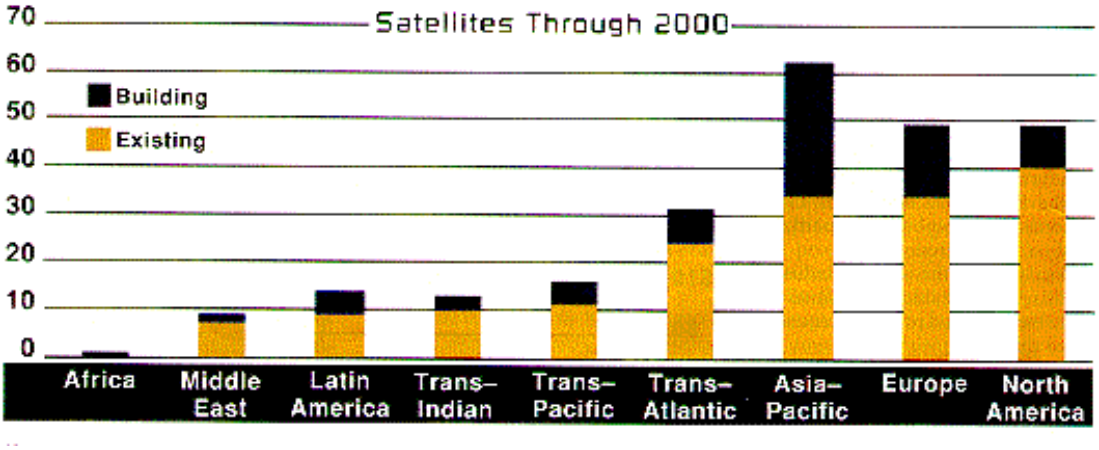

Table 1. Satellite Production Capabilities Worlwide

Gross revenues from GPS and other satellite related navigation systems now exceed $1 billion per year, and are expected to increase by a factor of 10X early in the next decade (Table 2).[4]

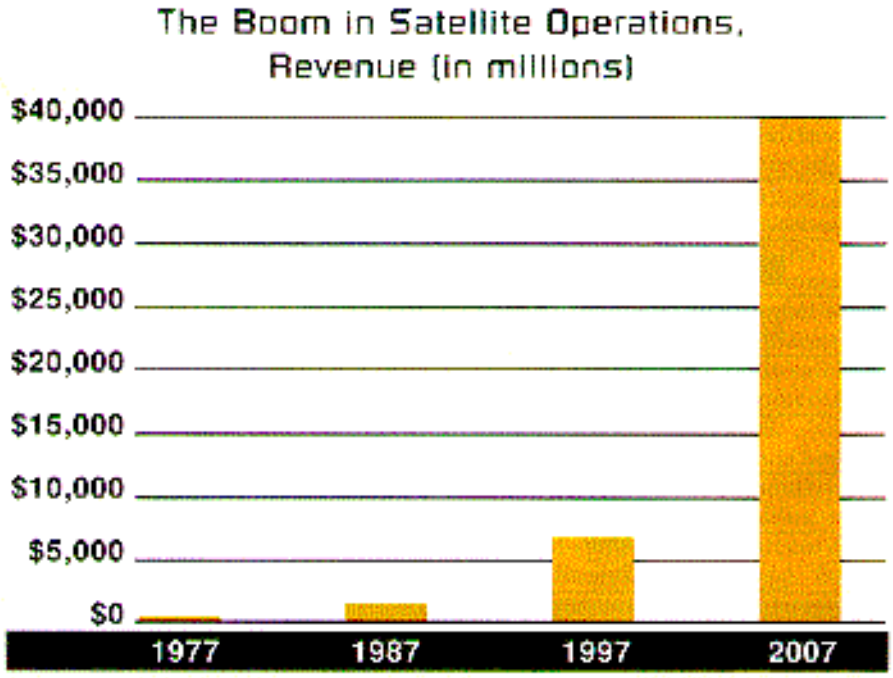

Table 2. Satellite Revenue Overview

It is estimated that within the next decade as many as 1,800 new satellites will orbit the earth, four times the current number of active satellites (Table 3).[5]

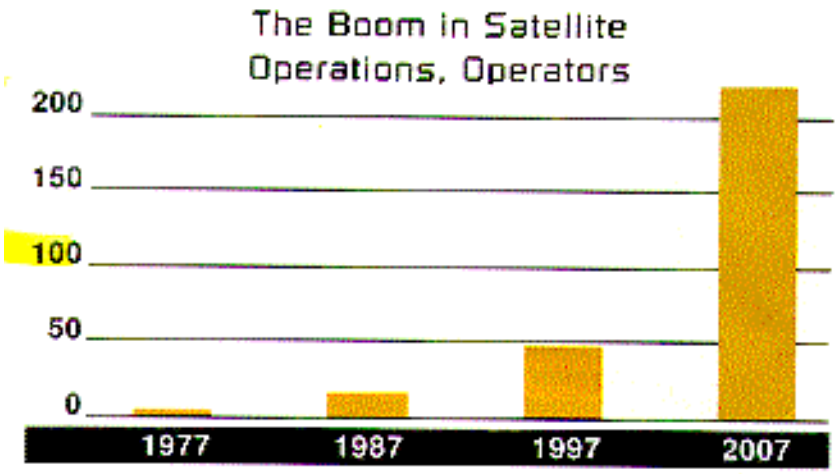

Table 3. Satellite operations overview

To accomplish this feat, about half a trillion dollars of investment will be spent over the next five years, including $121 billion contributed to space infrastructure in the US economy by the year 2000.[6]

The explosion in the commercial satellite industry is the result of an almost insatiable demand by consumers for worldwide services. In the U.S. alone, service sector businesses generated almost three-quarters of our Gross National Product.[7] In fact, all three major U.S. satellite manufacturers—Hughes Electronics, Loral Space & Communications, and Lockheed Martin—are shifting their focus from building $100 million spacecraft to providing vital services to telecommunications operators and consumers.[8] These services include mobile communications, Direct-To-Home satellite TV, and Internet access.[9] Mobile communications have moved from regional to global access through systems like the Iridium constellation mentioned earlier and already in service with the $3,000 Iridium telephone.[10] Direct-To-Home (DTH) satellite television already reaches 9 million U.S. homes and overseas virtually every large nation has one or more DTH operators.[11] Industry watchers expect subscribers will total 55.4 million by

2002, five times the number in 1997.[12] "Internet in the sky" will soon provide links to schools, factories, homes and offices.[13] Telecom billionaire Bill Gates, along with Motorola and Boeing, is founding a 288-satellite constellation called Teledesic to provide global Internet access.[14] This $9 billion system is scheduled to begin operating in 2003.[15] Other services include rural telephony to link remote villages, mobile laptop computer services, and new broadband or multimedia satellites for business consumers.[16] The experience gained by building Defense Department satellites like Milstar have provided companies like Motorola, TRW, Hughes, and Lockheed Martin valuable experience that is now being used on commercial satellite services.[17]

To underscore this trend, on Oct. 27, 1998, General Richard B. Meyers, Gen Estes' replacement as commander of Air Force Space Command, signed the first Commercial Operations Support Agreement. This agreement outlines the conditions "for government support, the allocation of risk to include insurance requirements, and financial arrangements for launch."[18] Representatives from Lockheed Martin, Boeing, and Orbital Sciences Corporation were on hand to sign the agreement.[19] This agreement, which also included environmental, safety, and security requirements, culminated two and half years of effort.[20]

An essential ingredient for success in the commercial space market has been the increasing need for international cooperation.[21] In fact, "multilateral projects and extensive coordination among all potential partners in a particular field are becoming increasingly common as all major space-faring nations encounter budget pressures yet desire to accomplish more in space."[22] A good example of this new spirit of cooperation is Sea Launch, an international venture led by Boeing that involves Russian, Ukrainian

and Norwegian organizations.[23] The venture uses a semi-submersible platform (former drilling rig) to launch large payloads into geosynchronous transfer orbit (GTO).[24] The self-propelled launch platform will be based out of Long Beach California and conduct launches from the Pacific Ocean.[25] Sea Launch uses the highly reliable two-stage Ukrainian Zenit rocket with a Russian upper stage.[26] Sea Launch already has 18 firm launch orders and is expected to relieve some of the increasing strain on available Western launch resources.[27] In the past, cooperation with the former Soviet Union was impossible because of the restrictions precluding US aerospace firms from entering cooperative business agreements with Russian entities.[28] With the end of the Cold War, however, Russia has emerged as a "major cooperative partner for the United States and other space-faring nations, offering "the potential for a significant increase in the world's collective space capabilities."[29] Because of the extensive Russian expertise in launch and propulsion technologies, most large US companies are involved in some type of joint venture or partnership with the Russians.[30] Russia has launched ten U.S. commercial satellites since 1996, and wants to launch another eleven into orbit in 1999.[31] NASA is also currently "exploring cooperative space research and development with Russia in virtually every programmatic area."[32]

Increasingly, the military is looking forward to a symbiotic relationship with its civil and commercial partners to help maintain its space edge in the 21st century. At the same time these commercial partners are finding it necessary to cooperate at all levels with other space-faring nations to realize collective efforts to accomplish more in space. Because of their vast experience, especially in the launch business, the Russians are a key player in almost any major project

involving space. In the next chapter we will look at the Russian space program and what it has to offer.

Notes

[1] Lt Col Larry K. Grundhauser, “Sentinels Rising, Commercial High-Resolution Satellite Imagery and Its Implications for US National Security," *Airpower Journal* XII, no. 4 (Winter 1998): 61.

[2] Theresa Foley, “Commercial Spacefarers,” Air Force Magazine 81, no. 12 (December 1998): 43.

[3] *Long Range Plan*, 2.

[4] Thomas F. Rogers, “Large-Scale Commercial-Industrial Business in the Human Space Flight Area,” *Space Energy and Transportation* 2, no. 2 (199): 91.

[5] Ibid.

[6] Ibid.

[7] Captain Mike Pierson, “The Aerspace Nation,” *Space Energy and Transportation* 3, no. 1 (1998): 9.

[8] Foley, 44.

[9] Ibid.

[10] Foley, 43.

[11] Foley, 45.

[12] Foley, 46.

[13] Foley, 44.

[14] Ibid.

[15] Ibid.

[16] Ibid.

[17] Ibid.

[18] “Myers signs historic commercial launch agreements,” *AUNEWS*, 3 November 1998, n.p.; on-line, Internet, 4 November 1998, available from http://www. usafnews@ afnews.af.mil.

[19] Ibid.

[20] Ibid.

[21] U.S. Russian Cooperation, 8.

[22] Ibid.

[23] Barry Miller, “SeaLaunch ,” *Launchspace Magazine*, October/November 1997, 43.

[24] Olav Sanner, “1999: A Sea Odyssey,” *Spaceflight Magazine* 41, (January 1999): 19.

[25] Sam Silverstein, Delta 3 Fallout Spreads to Sea Launch,” *Space News* 9, no. 34 (7-13 September 1998): 1.

[26] Dr. Victor F. Los, “U.S. – Ukraine Cooperation is Space,” *Space Science and Technology*, 9 October 1996.

[27] Sanner, 21.

[28] U.S. Russian Cooperation, 8.

[29] Ibid.

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[30] U.S. Russian Cooperation, 3.

[31] "Moscow, We Have a Problem," Reuters, 14 January 1999, n.p.; on-line, Internet, 20 January 1999, available from http://www.wired.com/news/news/technology/story/17338.html

[32] U.S. Russian Cooperation, 2.

Chapter 4

The Russian Space Industry, Protons to Prams

> *Struggling to make ends meet as government subsidies dried up, it* [the space industry] *also started making trolleybuses, tractors and children's prams.*
>
> —Reuters news quote [1]

The above quote puts into perspective the tremendous challenge the Russian space industry faces in the immediate and long-term future. Forced to face the economic realities of the capitalistic free market society it threatened militarily for so long, the once proud state-run Russian space program now must focus on the marketplace laws of supply and demand. The question is now whether the Russian Space industry can survive on its own merits. Can the industry survive without the massive government subsidies it has enjoyed for so long, and rely solely on years of hard won space expertise and experience alone?

Russia's Space Program, a Proud History

By just about any standard, the Russian space program over the last forty years has been an impressive undertaking. "Between 1957 and 1995, the Soviet Union and Russia launched 2,656 rockets which put 2,976 satellites into orbit."[2] Of these, 40% were launched from the Baikonur Cosmodrome.[3] During the peak launch years in the 1970's and 1980's, the Soviet Union was routinely conducting up to 100 launches a year.[4] Even

in the lean years since 1991, the Russians have managed to continue the pace, launching 46 rockets in 1994, compared to "26 by the United States, six by Europe, five by China, two by India and two by Japan."[5] The Russian space industry also employed one million people at its peak in the mid-1980's.[6] This unprecedented pace of operations has always made the Russian space program the busiest in the world. The "heart" of the Russian space effort has been its' three cosmodromes, each employing up to 100,000 people at one time.[7] The most famous of these cosmodromes, and the one that will figure most prominently in US/Russian cooperative programs, is the Baikonur launch facility, now located in the Republic of Kazakhstan. [8]

The Baikonur cosmodrome "is on the railway line between Moscow and the historic city of Tashkent."[9] This historic launch facility was completed in 1957 and was used to launch Sputnik, Soyuz, and Mir missions among many others from its famous R-7 pad.[10] It is the "oldest space-launch facility in the world and has supported more than 968 orbital missions."[11] Its' pads were also used for the basis of the "USSR's satellite-killer program."[12] The facility now has "nine rocket complexes, 14 launch pads (seven active at present), 35 technical facilities and three propellant fuelling stations. There were 19 launches from Baikonur in 1995, and it has been "host to a growing number of Western journalists and fare-paying tourists."[13] Baikonur has also been the focus of the most recent launches conducted in conjunction with US and other joint venture commercial undertakings, and figures prominently in Russia's future economic space plans. Baikonur cosmodrome has also been the focus of a great deal of concern by U.S. officials because of the essential role it plays in Russia's participation in the International Space

Station project.[14] Its' role as the launch facility for the commercial use of the Proton launch vehicle is also vital for commercial launches. [15]

Russia in the World Space Market

Despite the tremendous problems facing the Russian space program, it is striving valiantly to carve a niche for itself in the world space market. The hope is that with a minimum level of government funding and the privatization of key aerospace industries, the "real industrial, commercial and intellectual assets" of the Russian space program will survive and thrive.[16] This commercialization initially "took some bizarre and well-publicized forms," including offering cosmonaut training to tourists and auctioning off rare items of space history, including actual space cabins and suits.[17] The largest Russian design bureau, Energiya, was quickly privatized and joint international commercial enterprises were quick to follow. American companies especially "were quick to realize the potential of Soviet-designed rocket engines."[18] The Russian engines could "deliver 10% more performance than any other American engine," and US companies were impressed by the "simplicity, lightness and low production costs" of the Russian engines.[19] The Russians were also offering their wares at significant cost savings over the Americans or Europeans. In fact, this led to the United States restricting "Russia to not more than eight commercial satellite launchings by 2000 and prohibited Russia from offering launches at less than 7.5% below the nearest Western offer."[20] As well might be imagined, these restrictions are a hotly contested issue and "American satellite manufacturing companies have tried to work their way around the restrictions and quotas." [21] Moscow also had originally hoped that the launch restrictions would be relaxed to allow an expanded number of satellite launches in 1999.[22]

Other advantages to using Russian facilities and equipment include the Russians' robust launch capability. As the Americans delay launches owing to small changes in temperature or passing thunderstorms, the Russians are used to "tunneling through snow to launch rockets in temperatures of –30 degrees C in the wintertime."[23] Turnaround times are also vastly different. "Turnaround times in Baikonur are the fastest in the world—five hours on the Zenith pad, six on the R-7 (the minimum at Cape Canaveral is a month)."[24]

Since there are so many apparent advantages to using Russian equipment and facilities, the list of aerospace companies collaborating in joint ventures with the Russians reads like a veritable "who's who" of the aerospace industry. One of the most ironic and striking examples of these new ventures is the use of a Russian engine to launch the new generation of National Reconnaissance Office Space-Based Infrared System (SBIRS) missile warning satellites.[25] The rocket is produced by a joint venture of Lockheed Martin in cooperation with Russia's AMROSS firm.[26] Other American companies participating in joint ventures include: Laurel Space Systems which will put 12 of its satellites into orbit from the Baikonur cosmodrome with the aid of Russian Zenit-2 launchers, the commercial version of the once dreaded SS-18 that formerly threatened the West; Lockheed uses the Russian Proton launcher for its space programs; Boeing is also cooperating with Russian firms, using parts from the Zenit-2 launcher to put "satellites into orbit from a sea platform situated at the equatorial latitude."[27] The Russians will also "supply Boeing with the key, fourth, stage of the launcher."[28] In December of 1997, a political firestorm was also ignited over questions of technology

transfer when a Proton launcher was unable to "put into orbit a Chinese satellite that Beijing had bought from the United States."[29]

These American companies are just a small sampling of the many joint ventures formed not only with the US but also with companies around the world seeking the financial and experiential advantages of the Russian aerospace industry. One un-named Pentagon officer put the matter succinctly when asked about recent congressional hearings over the Chinese technology transfer "flap": "For American companies the economic advantage from cooperation with the Russians as with the Chinese surpasses the potential political risk."[30]

Challenges Facing the Russian Space Program

Despite the demand throughout the world for Russian space technology, hardware, and experience, the Russian space industry, like the rest of the Russian Military Industrial Complex, is facing some serious problems. These include the reduction in government subsidies and subsequent serious neglect of infrastructure and personnel.

The magnitude of the Soviet collapse on the national space program has indeed been staggering. Some Western analysts estimate that the real level of investment in the Russian space program fell "80% from 1989 to 1995," putting it behind the US, France, Japan, China and Germany in terms of financing.[31] The disintegration of the "world socialist system," to include the Warsaw Pact and extensive overseas markets has had an enormous effect on Russia's Military Industrial Complex (MIC).[32] Formerly one of the prime drivers for economic health in Russia, "MIC enterprises dropped by 16.4%, and the military products manufacture fell by 31.6% in 1997" alone.[33] Although commercial space activity brought Russia $470 million in 1996, with the magnitude of cuts in

government subsidies experienced since the break-up of the USSR, the Russian space industry cannot possibly retain its former stature.[34]

The reduction in subsidies has had a devastating impact on the space infrastructure. The famous Baikonur launch facility provides a good example. After the disintegration of the Soviet Union, Baikonur, like other key space factories and production facilities was located outside the territory of Russia. It became the property of the newly independent Kazakhstan Republic, near the city of Leninsk. Baikonur, like the other two Russian cosmodromes, is witnessing the precipitous decline of its facilities and the rapid wearing out and breaking down of 1950's-era equipment.[35] This degradation of facilities is especially acute in Baikonur where temperatures range from –45 to +55 degrees C and facilities are buffeted by fierce winds coming off the semi-desert east of the Aral Sea.[36] The physical decline has also had a devastating effect on the personnel manning the launch facility. "Living conditions in the workers' city of Leninsk are as bad as conditions at the physical plant."[37] "The lack of heat, functioning plumbing, reliable electricity, and safe drinking water continues to drive away current workers and discourage most potential replacements."[38] Some employees have been walking off with pilfered electrical components and even breaking into the cosmonauts food provisions.[39] They have been making off with cans of borscht and as many rations of vodka as they could carry.[40] Crime and drug addiction is rampant and at one point frustrated Russian soldiers rioted, burning down a number of buildings in protest to the difficult living conditions.[41] There are also plans now to cut the already reduced 12,000-member military launch unit to 755 officers.[42] "Privation, uncertainty, and physical dangers create conditions under which no Western government would expect air traffic controllers or

nuclear power plant operators or space workers to operate safely … the environment comprises a classic recipe for inattention, error, or even sabotage."[43] Underemployed operators have grown less skilled and even careless, with fires becoming more common within the assembly halls and even at the launch pads.[44] Just an hour before one launch, the power went out at the launch site and was only restored through emergency measures.[45]

Despite Russian plans for an infusion of money for improvements in infrastructure and help from western companies interested in keeping the cosmodrome on its feet, these will fall well short of the estimated immediate $100 million needed to reverse the launch facilities' collapse.[46] With the economic pressures facing Russia at the moment, it is doubtful that the needed subsidies will be forthcoming in any case. In fact, "since the dissolution of the Soviet Union in 1991, the space program has been coasting on strategic reserves… cannibalizing the last redundant equipment—in short, eating the seed corn."[47] Despite outward appearances, the necessary investments are not being made in the Russian space industry to ensure its long-term survival on par with anything it has accomplished in the past. Although the program will continue at some reduced level, the risk for those investing in joint ventures with the various parts of the Russian space industry are enormous and growing every day.

Notes

[1]Pavel Polityuk, "Computer Fault Causes Ukrainian Rocket Crash," *Reuters*, 10 September 1998.

[2] Brian Harvey, "The New Russian Space Programme," Space Science and Technology, 1995, 141.

[3] Ibid.

[4] Ibid.

[5] Ibid.

[6] Harvey, 168.

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[7] Harvey, 141.
[8] Ibid.
[9] Harvey, 144.
[10] Harvey, 145.
[11] U.S. Russian Cooperation, 35.
[12] Harvey, 146.
[13] Harvey, 149.
[14] U.S. Russian Cooperation, 75.
[15] U.S. Russian Cooperation, 75.
[16] Harvey, 172.
[17] Harvey, 171.
[18] Harvey, 173.
[19] Ibid.
[20] Harvey, 172.
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[22] "Moscow, We Have a Problem," Reuters, 14 January 1999, n.p.; on-line, Internet, 20 January 1999, available from http://www.wired.com/news/news/technology/story/17338.html
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[26] Ibid.
[27] Ibid.
[28] Ibid.
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[32] Dr. Stanislav Simanovsky, "Problems and Prospects for Russian Industry," *Interavia* 53, no. 622 (July-August 1998): 18-20.
[33] Simanovsky, 19.
[34] Ibid.
[35] James Oberg, "Russia's Space Program: Running on Empty," *Spectrum* 32, no. 12 (December 1995): 18-35.
[36] Oberg, 26.
[37] Oberg, 24.
[38] Ibid.
[39] Jeffrey Kluger, "Who Needs This?" *Time*, November 23, 1998, 88.
[40] Ibid.
[41] Sergei Leskov, "Notes From a Dying Spaceport," *Bulletin of the Atomic Scientists* 49, no. 8 (October 1993): 40.
[42] Alexander Bratersky, "New Company to Coordinate Russian Launch Policies," *Defense News*, February 23-March 1 1998, 22.
[43] Oberg, 24.

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[44] Ibid.
[45] Leskov, 40.
[46] Oberg, 24.
[47] Oberg, 18.

Chapter 5

Benefits of U.S./Russian Space Cooperation

> *Russia has more operational experience with long duration human spaceflight than does the United States.*
>
> — Technology Assessment Board of the 103rd Congress[1]

Cooperation with Russia is very much in concert with the Clinton Administration's National Space Transportation policy that states "the U.S. Government will seek to take advantage of foreign components or technologies in upgrading U.S. space transportation systems or developing next generation space transportation systems."[2] Russia's vast experience as a space-faring nation has for years "provided the impetus for a U.S. manned program."[3] The Russians have much to offer in components and technology to help the U.S. in developing future systems for the commercial and civil sectors. The Russian aerospace industry also has provided many opportunities to fulfill U.S. political and foreign policy objectives as well.

The Russian aerospace contribution to the commercial space market is unmatched in many areas, especially in launch technology. Their advances in both hardware and underlying technology developments "can fill important gaps in U.S. capabilities" and prove invaluable to the U.S. aerospace industry.[4] Developments in automated launch capabilities, advanced materials and materials processing, computational methods, and access to different and up-to-date technologies and cheaper processing methods "could

make the U.S. aerospace industry stronger in an ever more competitive world market for space-related services."[5]

The most high profile civil project, and cornerstone of the new willingness of the United States to work with Russia on science and technology programs, is the International Space Station (ISS). In December 1993, Vice President Al Gore and Russian Premier Viktor Chernomyrdin announced the cooperative effort.[6] The ISS also draws upon the scientific expertise and resources of fifteen other nations besides the Russians.[7] The project utilizes the proven capabilities of Russian (and Ukrainian) participation, taking advantage of their strengths in the availability of robust, reliable launch vehicles, rapid payload processing, and associated technologies.[8] Space station planners anticipate that the Zenit launch vehicles will be an integral transportation element in the space station project permitting some missions that could not otherwise be undertaken.[9] The Service Module, which provides the living quarters and life support systems for the initial cadre of astronauts, is the vital cornerstone for the first human habitation of the station.[10] The recent cooperative effort on Shuttle-Mir docking program has produced valuable lessons that will apply to the station program and have been a real bargain in financial and programmatic terms.[11] U.S. astronauts have spent a total of 32 months aboard Mir since March 1996, which is considerably more experience than they would have gained through U.S. Space Shuttle missions alone.[12] NASA has also been involved with feasibility studies exploring complementary uses of Russia's deep-space communication assets. The 70-meter-class antennas could prove extremely useful in relieving the high workload of NASA's Deep Space Network.[13]

Besides the technological advantages that can be gained by cooperation with Russia, there are a number of political and foreign policy objectives that can be realized. In conjunction with the space station and the Shuttle-Mir docking program, the National Aeronautics and Space Administration (NASA) will purchase nearly $650 million in goods and services from Russia.[14] This represents by far the largest transfer of U.S. public funds to the Russian government.[15]

The transfer of these funds serve a number of political and foreign policy interests. They are first of all an important signal of U.S. support for Russia's transition to a market economy.[16] The money should also help preserve jobs for Russia's talented engineers and technicians. Stemming this "brain drain" from the scientific community is very important to prevent Russia's best and brightest from seeking employment abroad.[17] Russian scientists, especially those working on ballistic-missile programs, are highly sought after in developing nations and with dwindling opportunities in the Russian space industry these opportunities are very tempting.[18] As these people leave Russia, they increase the potential for the proliferation of military technology and also weaken the opportunities for economic development at home through defense conversion.

Cooperation with the Russians and significant investments in their economy has also been linked to securing Russia's continued adherence to the Missile Technology Control Regime (MTCR).[19] The regime is an important ingredient in preventing Russia's vast reservoir of missile technology from migrating to other countries. Maintaining a viable Russian space program is a vital component to bolstering the Russian's commitment to this regime.

The United States stands to gain much from cooperation with the Russians when it comes to space. Their extensive experience has the potential to benefit both U.S. civil and commercial space ventures. It has also provided a unique opportunity for U.S. policy makers to aid the Russian people in their transition to a market economy. Although the advantages have great potential, there are still risks involved.

Notes

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[2] U.S. Russian Cooperation, 68.

[3] David A. Brown, "International Space Station Faces Further Delays, Contoversy," *Launchspace Magazine*, June/July 1997, 30.

[4] U.S. Russian Cooperation, 23.

[5] U.S. Russian Cooperation, 80.

[6] Vladimir Karnozov, "Russian ISS Modules," *Launchspace Magazine* Web Site, 1997, n.p.; on-line, Internet, 12 February 1999, available from http://www.launchspace.com/mag/0306/russianISSmodules.html

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[14] U.S. Russian Cooperation, 2.

[15] U.S. Russian Cooperation, 2.

[16] U.S. Russian Cooperation, 2.

[17] U.S. Russian Cooperation, 70.

[18] U.S. Russian Cooperation, 79.

[19] "Moscow, We Have a Problem," *Reuters*, 14 January 1999, n.p.; on-line, Internet, 20 January 1999, available from http://www.wired.com/news/news/technology/story/17338.html

Chapter 6

Risks of U.S./Russian Cooperation

> *The president is old, tired, and very possibly senile. Hyperinflation is making the currency worthless. Once a great power, the country feels beaten down, and its weak democracy may soon be crushed by a hybrid of nationalism and socialism. Is this Russia in the 1990's? Or Germany on the eve of Hitler taking power?*
>
> —*U.S. News & World Report*, Nov 16, 1998

> *One basic rule is familiar to anyone who has ever made a wager – be able and willing to cover your losses if you lose. As NASA informs the White House and Congress that the U.S. gamble on bringing Russia into a central role in the space station partnership is not working out, and that additional U.S. funding will be needed if Russia is to fulfill its commitments, this maxim is worth remembering.*
>
> —*John M. Logsdon, Space News*, Oct 18, 1998[1]

Almost any discussion of risk concerning Russia and its space industry must center on the instability of that country's political institutions and economy. Uncertainty, regression and collapse in these entities will have a profound effect on U.S. commercial, civil and military space operations. Despite the benefits, the risks of doing business with Russia at this point in history are enormous and growing worse every day.

The Russian economy has shrunk relentlessly in the last few years. The gross domestic product fell 5 percent in 1998 and is forecast to drop an additional 3 percent this year.[2] Russia's state budget is now down to $26 billion per year, less than the U.S. government spends in a week. "At least 70 percent of Russians live near or below the

subsistence level. Over 40 million live below the official poverty line of just under $40 a month, compared with 31 million in November 1997. Forty percent of Russia's children are chronically ill. Tuberculosis has struck down 100,00 people, and some 2 million may well be exposed."[3]

With weak leadership and the economy in shambles, the parallels between contemporary Russia and Germany's Weimar Republic are frightening.[4] The devaluation of the ruble, hyperinflation and printing of additional currency all point to an economy in freefall and on the verge of collapse. The new rhetoric blaming "a conspiracy of scheming Jews and vengeful Westerners" is frightfully similar to the rhetoric and events of Germany 50 years ago.[5] Acting in concert with the hemorrhaging Russian economy, is the unprecedented increase in organized crime, which is now thriving in Russia. It is now estimated that the Russian "Mafiyas" crime element controls 40-50 percent of the Russian economy.[6] It is also estimated that up to 30 percent of the illegal income of organized crime is spent on bribing government officials and that as much as 80 percent of all businesses in Russia pay protection money.[7] Other institutions have been equally destabilizing in Russian, creating additional risk for U.S. aerospace firms. Russian institutions such as their legal system have been undergoing rapid change. Some "observers have described the situation in Russia as resembling that in the United States during the 19th century's robber baron" era. Sudden, unexplained changes in basic business law and regulations are commonplace, as are corruption and, increasingly, crime.[8]

Another institution affected by the economic crisis is the once proud Russian military. Although it is now possible to separate the civil and military parts of Russia's

space program, the military still plays an important role in the establishment of business relationships with Russian companies.[9] As a matter of fact, many agreements require the consent of the Russian Ministry of Defense and the Military Space Forces.[10] It is especially concerning then, that the problems in the military are equally as disturbing as other sectors of society. One senior Russian commander recently instructed his troops to take their families and "go into the countryside and forage for mushrooms and wild game" in order to survive.[11] "The Russian military is a demoralized an ineffective fighting force."[12] Soldiers have not been paid for four months, as many as 100,000 officers lack adequate housing and infectious disease is spreading dramatically among the force.[13] It seems that no sector of the Russian society has escaped from the impact of impending economic collapse. All of these incidents have implications for joint U.S./Russian ventures in all of the space cooperation arenas, commercial civil, and military.

For the commercial sector, the risks are obvious. With most large aerospace firms engaging in some form of joint venture especially in the areas of launch and propulsion technologies, the ramifications for a wholesale collapse of the Russian economy are obvious.[14] Many of these firms were counting on the Russian space industry to help fuel the tremendous commercial market influx in space. The new Teledesic communications constellation alone will consist of 288 satellites! This constellation alone will require 20 flights per year over a three year period to get all of the satellites in Low Earth Orbit (LEO).[15] With the shortage of launch technology and vehicles and tremendous increase in launch demand, any interruption of the Russian supplied launch technology will have severe impacts on the commercial space industry. These risks were underscored recently

when a Ukrainian Zenit-2 rocket launched out of Baikonur crashed destroying all 12 commercial satellites owned by the Globalstar telecom consortium.[16] Loral Space and Communications lead this consortium.[17]

As mentioned earlier, the U.S. government has limited the number of Russian launches U.S. firms are allowed to access. Additional launches for 1999 are currently being held hostage to U.S. foreign policy constraints.[18] Russia's willingness to cooperate with Iran in the transfer of sensitive launch technology violates the MTCR. The loss of the four additional launches planned for 1999 would cost Moscow U.S. $280 million.[19] In an ironic twist of fate, this would have an immediate and direct impact on the American companies involved as well.

On the civil side of the house, the Russians are playing a pivotal role in the completion of the International Space Station. NASA, supported by the U.S. Congress and the White House, has pinned high hopes on the success of this program.[20] The benefits for the White House and Congress encompass broader political and security goals while NASA's interest are much more parochial. In both cases the parties knew the decision would be risky, even when taken back in 1993.[21] In recognition of their extensive experience in space, the Russians contribution was made a critical element in the path to completion of the station. While a boost for national prestige, this situation poses unprecedented programmatic, economic and political risks. If Russian elements are not delivered on time and within budget, NASA will have serious problems with other station partners and the U.S. Congress.[22] In fact, this scenario is already being played out as NASA recently approached the White House and Congress for additional funding to help the Russians meet their commitments.[23] The concerns increase daily as worries

about the viability of the Russian aerospace sector, the capability to deliver new spacecraft, and the condition of the Baikonur launch complex continue to grow.[24] The Russian delay-plagued Service Module is now running more than a year behind schedule due to funding problems.[25] The Russian State Duma recently passed their draft budget for 1999, capping the Russian Space Agency's budget at $126.6 million.[26] The Russians estimate that it will cost nearly $300 million just to support their end of the ISS alone, not counting any of the agencies other programs. Yuri Artyomov of the Russian Space Agency's finance department lamented that "we will have to disband and the space industry will be destroyed." Given the critical nature of the Russian contribution to the space station, the "U.S. ability to make up for delays or failure to deliver is severely limited by available U.S. resources."[27] With the current instability in the Russian political and economic climate, we are seeing the hazards of putting Russian aerospace performance in the critical path to completion of the ISS.

The ramifications extend beyond the commercial and civil sectors as well. Instability in the Russian aerospace sector will affect U.S. military space operations, both directly and indirectly. This is a result of the increased dependency on commercial industry. One direct result would be the delay of launcher engines produced by Lockheed Martin's joint venture with the Russian aerospace industry. As mentioned above, this launcher engine will be used to launch components of the Space Based Infrared System used in our National Missile Defense Program.[28] Russian economic instability could further delay this important defense system that is already experiencing deployment delays due to U.S. budget constraints.[29]

Another area of real concern for the U.S. is the unauthorized transfer of sensitive technology. We have already seen this scenario become reality as the Chinese acquired sensitive technology during the aborted launch of a Space Systems/Loral Intelsat satellite on their Long March rocket.[30] U.S. investigators found that China obtained technology that could increase the accuracy of the nuclear tipped Intercontinental Ballistic Missiles.[31] A special House committee, chaired by Rep. Christopher Cox, found that Beijing was deliberately "targeting militarily sensitive technology."[32] The Senate Majority Leader, Mr. Trent Lott, among other legislators, is very concerned about the possibility for unauthorized transfers of technology as a result of U.S. firms cooperating with foreign governments.[33] As mentioned above, U.S. concerns over Russian leaks of missile and nuclear technology to Iran recently precipitated the suspension of all Russian launches of U.S. commercial satellites.[34] Although a new Technology Safeguards Agreement was recently signed lifting the suspension, the potential for unauthorized transfers of technology not only to Russia, but to other countries as well is clearly going to be a problem in the future.

Indirect effects would be many and varied. Any joint venture aerospace firm doing business with the Russians, which includes just about every major one now would be affected by Russian economic instability. Since the U.S. military is increasingly dependent on commercial assets for communication, navigation, weather, launch capability etc., the impact could be far-reaching. This impact will only grow more pronounced as the partnership between military and civil space grows, and we see the increased globalization of the space industry.

All of these areas of concern have raised the degree of skepticism among Russian foreign policy-makers on whether these partnerships with Western countries are indeed productive.[35] Some are beginning to feel that the West, and the United States in particular, "plans to undermine Russia's status and turn it into a source of raw materials for the developed world."[36]

Finally, all of these factors raise alarming questions about our increasing dependence on Russian space programs. We are indeed entering uncharted waters and the potential for miscalculation is enormous and potentially devastating. The precipitous decline of Russia in all areas risk is already mitigating any potential benefits we might have gained in cooperating with the Russians.

Notes

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[6] Tom Hunter, "Russia's Mafiyas: The New Revolution," *Jane's Intelligence Review* 9, no. 6 (1 June 1997): 247.

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[11] Richard Cheney, Former Secretary of Defense in his remarks during the Annual Report of the Secretaries of Defense at The Southern Center for International Studies in Atlanta Georgia, Friday, November 6, 1998.

[12] Sherman Garnett, "Russia's Illusory Ambitions," *Foreign Affairs* 76, no. 2 (March/April 1997): 61-76.

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[36] Ibid.

Chapter 7

Conclusions, Looking into the Crystal Ball

> *The US military must guard against having our dependence on space turn into vulnerability.*
>
> —General Howell M. Estes III[1]

> *Russian launch vehicles and related systems have the most obvious potential for U.S. commercial use, but using them could adversely affect the U.S. launch industry.*
>
> —Technology Assessment Board of the 103d Congress[2]

As we move into the 21st century, we are seeing the baton of space technological innovation passing from the civil/military sector to the commercial sector. The emerging potential for enormous financial gain in the satellite services industry especially has sparked an entrepreneurial firestorm around the world. This storm has opened the door for vast potentialities in the space arena. As the civil/military sector experiences continued reductions in funding, infrastructure and personnel, the potential benefit of partnering with the commercial sector in space programs is indeed tempting. As the U.S. civil/military sector continues to struggle with the expensive and vexing launch problem, commercial space companies are becoming more and more creative in solving this issue. In fact, the possibilities for "contracting-out" this thorny problem are almost is almost too good to be true. Although the infrastructure, experience and equipment necessary to launch satellites into orbit is limited to a very few number of spacefaring nations, with the

emergence of new multinational space consortiums, these problems are now being overcome. The sharing of space expertise in these new cooperative efforts has almost become a necessity because of the relative scarcity of the necessary infrastructure and equipment.

Because of their vast space experience and space related resources, Russia has found herself increasingly at the center of this new global space interdependence. With tremendous launch capability left over from the Cold War, we are finding bits and pieces of Russia's space capability cropping up in almost every joint space adventure, to include helping to launch some of our most sensitive military satellites, a concept that makes a Cold Warrior's hair stand on end. For many of the reasons stated earlier, Russia has also become a centerpiece of our civil space effort as well, being placed smack in the middle of the critical path to our ISS efforts. The use of Russian expertise, equipment and infrastructure has many benefits for the U.S., not the least of which is contributing to our foreign policy objectives. The problem is our increasing interdependence in all sectors on Russian.

As Lt General Lord said in a recent speech to the FAA, "space is becoming an economic center of gravity and an area of vital security interest."[3] As a center of gravity, space also becomes a vulnerability for the United States. We are increasing this vulnerability incrementally by moving more and more to partnerships with industry and partnerships on global projects like the ISS. Our commercial, civil and military interaction with Russia is a prime example of this vulnerability. The continued descent into the maelstrom of economic and social decay that Russia is experiencing makes our position more precarious every day. NASA is finding this to be painfully true as the

critical participation of Russia in the ISS falls farther and farther behind. The instability of Russian political vagaries is proving increasingly troublesome as we see our own space industry become more dependent on Russian technology and equipment. There is also much less certainty over the control of critical missile technology transfers s well, despite the assurances from Moscow. In short our sanguine ideas about how "partnering" will solve all of our budget and resource problems is proving to be our new Achilles heal. Our dependence on Russian space resources is a bad idea and this is being borne out daily in the news. We are indeed being "taken for a ride!"

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